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PROJECT NO. 1110

SPECIFICATIONS FOR

WATERPROOF AGENT RADIO TRANSMITTER RT-3

THIS SPECIFICATION APPLIES TO CIA INVITATION NUMBER ___ ONLY.

CENTRAL INTELLIGENCE AGENCY

2 June 1949.
(From original 8 Oct. 1948)

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SECRET

8 June 1950

AMENDMENT NO. 1

TO THE SPECIFICATIONS FOR WATERPROOF AGENT RADIO TRANSMITTER RT-3, PROJECT NO. 1110 DATED 2 JUNE 1949.

Delete Paragraph 5 (c).

SECRET

Specifications for Waterproof Agent Transmitter

A. General

This specification describes a crystal-controlled, waterproof radio transmitter capable of delivering up to 15 watts output from 3.5 to 22 megacycles, A-1 emission. The power supply is a separate item and is covered by a separate specification.

1. Operating Conditions

(a) Ambient Temperature: -10°C. to +60°C.

(b) Ambient Humidity: 0 to 100%

(c) Duty: two hours on (on-off keying) and two hours off, and repeat.

B. Electrical Requirements

1. Circuit Description (See drawing #1110-1)

The electrical circuit consists of a "Pierce--Electron-Coupled" oscillator and frequency multiplier, employing a 6AC7 tube, with the screen grid acting as the anode of the Pierce oscillator. Frequency multiplication is obtained in the plate circuit of this tube, which drives (at the output frequency) a 2E26 tube as a class "C" amplifier. Both stages of the transmitter are keyed in their cathode circuits. Combination cathode and grid leak bias is utilized. Output of the transmitter is coupled to the antenna through a pi-coupler network. Provision is made for utilizing the antenna for a receiver for break-in operation.

2. Frequency Coverage & Control

The transmitter shall provide continuous frequency coverage from 3.0 to 22 megacycles through a system of ganged bandswitching.

Approximate coverage for each band shall be:

Band	Coverage in Mc.
1	3.0 to 5.5
2	5.5 to 9.0
3	9.0 to 16.0
4	16.0 to 22.0

Frequency control shall be by means of crystals cut to one half or one third the output frequency. Fundamental crystals may be used, also, for frequencies up to 7.5 megacycles, but lower frequency crystals are preferable.

3. Controls, tuning indicators, and terminals (See drawing #1110-3)

(a) The panel shall have accessible the following controls: Excitation tuning, amplifier tuning, bandswitch, key, and antenna loading. The excitation and amplifier tuning controls shall have suitable logging scales marked 0 to 100 through 180°. The antenna loading control shall be marked 0 to 90 both clockwise and counterclockwise through 162° for low and high impedance matching. The low and high impedance range shall be plainly marked.

(b) Adjacent to the excitation and amplifier tuning controls, small (1/25 watt) neon bulbs shall be used to indicate

resonance of these two circuits respectively. An incandescent lamp, in series with the antenna terminal shall be used to indicate maximum antenna current.

(c) Terminals on the panel shall include: external key terminal and ground, receiver antenna terminal, crystal sockets for both .486 inch (.093" dia) and 3/4 inch (.125 dia.) spacing, antenna and adjacent ground terminal, and power cord as integral part of the transmitter. Terminals shall be clearly marked as to function.

4. Power Output

The transmitter shall be capable of power output of 15 watts from 3.0 to 15 megacycles and not less than 12 watts from 15 to 22 megacycles. A self-contained pi-matching system, capable of matching unbalanced loads from 50 to 1000 ohms impedance shall be provided. Additional capacitance for matching low impedance loads shall be automatically switched into the pi-matching system when the antenna loading control is turned through 162° (counter-clockwise) of its rotation. Through the clockwise 162° of rotation, this additional capacitance is not in the circuit.

5. Keying and keying characteristics

Keying characteristics of the transmitter shall be clean and free from transients. Oscilloscope pattern shall show definite rounding of leading and trailing edge of dot and dash pulses. No frequency shift with keying shall be tolerated. Transmitter must be capable of keying speeds up to 60 wpm.

6. Power Input

Transmitter shall operate from an external power source which delivers 4 0 volts dc at 90 milliamperes maximum and 6.3 volts ac or dc at 1.3 amperes.

C. Mechanical Requirements

1. Case and Waterproofing (See drawing #1110-2)

The case shall be watertight construction with a removable top cover. Material for case and cover shall be cast magnesium alloy. Waterproofing of the case shall not depend on the top cover, however, cover shall be so constructed that it forms a water-proof seal with the panel when fastened down. All controls shall operate through watertight glands. A replaceable desiccator cartridge shall be provided. The waterproof test shall consist of immersion in water and by means of air line to the unit it shall withstand an internal air pressure of 7.5 pounds per square inch with no air leakage as evidenced by air bubbles.

2. Weight and Dimensions

(a) Total weight of the transmitter, including top cover shall not exceed 8½ pounds.

(b) Unit shall be 8 5/8 inches long, 5¼ inches deep and 5½ inches wide.

3. Mechanical rigidity

Transmitter shall be capable of withstanding drop tests equal to "C.A.A. Drop Test" described in C. A. A. Manual 16.

Tubes shall be held in sockets by means of tube clamps.

4. Tropicalization

All components shall be fungus treated prior to installation wherever possible. Entire assembly shall be fungus treated upon completion. All wire insulation material shall be fungus proof.

5. Tuning Chart and Schematic

The panel shall be lettered with a tuning chart which indicates approximate settings of all tuning controls for each megacycle point within the range of the transmitter. The columns shall be marked with numbers and the respective controls numbered with corresponding numbers. (See drawing #1110-3)

A complete electrical schematic including values of all component parts shall be attached to the inside of the bottom of the case. This may be of paper, coated with clear fungus proof varnish.

D. Special Considerations

1. General

(a) Components shall be placed so that heat rise within case is limited to safe operating temperature of all components.

(b) Exact placement of major components is dependent principally upon the layout of the top panel of the unit. Drawing #1110-3 shows the approximate location of all

tuning controls, terminal posts, crystal sockets, key, etc. As far as possible, this layout shall be adhered to, but minor changes are permissible if necessary for the manufacture of these units.

(c) A laboratory model of the transmitter described in these specifications is available for inspection. Wherever the laboratory model differs from the written portions or the drawings made part of this specification, the specification shall apply, that is, shall supercede the model.

(d) Details of the mechanical structure which are not shown in the contained drawings shall be done according to the best engineering practice. All resistors, condensers, and RF chokes shall be mounted on terminal boards, coils shall be rigidly mounted at both ends so as not to be affected by vibration, and solder joints shall be good mechanical and electrical joints.

(e) The antenna lamp socket assembly S03 must be fitted with a cap structure so that by rotation of this cap, not to exceed 180° the lamp is dimmed by shutter action.

2. Components

(a) General

Components to be employed must adhere to type and/or manufacturer when specified on the parts list. Where manufacturer is not specified, components shall be chosen according to best commercial practice. Suitable markings shall be placed adjacent to each component to indicate

its part number according to the parts list and schematic. For example: R-2, C-4, etc.

(b) Capacitors

All capacitors employed for the purpose of radio frequency by-passing or blocking functions shall conform to JAN-C-5 of 20 April 1944.

(c) Resistors

All resistors shall conform with JAN-R-11, 31 May 1945.

(d) Insulating Materials

Polystyrine may be used as material for inductance structures and supports except at points where heat may alter physical or electrical characteristics of such material. Terminal boards shall be of fungus resistant insulating material.

(e) Vacuum Tubes

The Type 6AC7 shall be in accordance with JAN-1A, 15 Nov. 1945. The Type 2E26 according to a pending JAN specification if available 30 days before termination of any contract resulting from this specification.

3. Title and Serial Number

The serial number of the units shall begin with 101 and run consecutively. The title plate shall be in accordance with that on drawing #1110-3.

4. Accessory Boxes

With each unit, an accessory box shall be provided for storage space of spare parts, antenna wire, etc. This box shall be of aluminum-waterproof construction. The lid shall fasten securely with a quick-open fastener system and shall include

a gasket for waterproofing. See drawing #1110-4.

5. Spares and Accessories

(a) Each unit shall be provided with the following spares.

1--6AC7 tube

1--2E26 tube

2--spare antenna lamps (#47)

1--Allen wrench (knob set screws)

1--Phillips screw driver

1--spare tuning knob

(b) The following accessories are to be furnished.

1--100 ft. coil, rubber covered ant. wire. #18 stranded, black.

4--Small plastic or ceramic antenna insulators (similar or equal to Birnbach #474 1½" long, air plane type)

1--25 ft. coil, rubber covered wire suitable for ground lead, #18 stranded black.

1--ground clamp of the "C" type.

(c) A Base spare parts kit consisting of 100% on all components, not including case, cover or front panel, shall be provided for each ten of the complete units. The kits shall contain a packing slip showing contents and each component shall be separately wrapped and properly labeled.

PARTS LIST

Part No.	Description	Manufacturer	Manufacturer's Type No.
C-1, C-2, C-9, C-13	Capacitor, .01 mf, 500 volt, mica		
C-3	Capacitor, 22 mmf, 500 volt, mica		
C-4	Capacitor, .0015 mf, 500 volt, mica		
C-5	Capacitor, 10 mf, 150 volt, electrolytic, metal container, hermetically sealed.		
C-6, C-12	Capacitor, Variable, 140 mmf	Cardwell	ZU-140-AS
C-7, C-14	Capacitor, 18 mmf, 500 volt, mica		
C-8, C-10, C-11	Capacitor, .003 mf, 500 volt, mica		
C-15	Capacitor, 150 mmf, 500 volt, mica		
C-16	Capacitor, Variable, 200 mmf, w/ switch	R D R	8-TW-15
K-1	Key, miniature, waterproof mounting	R D R	116-T-12 (modified)
L-1	Inductor, 48 turns, 3/4" dia, 1½" long, tapped at 19 turns	B & W	3012
L-2	Inductor, 14 turns, 3/4" dia, 7/8" long, tapped at 8 turns	B & W	3011
L-3	Inductor, 48 turns, 1" dia, 3" long, tapped at 20 turns, w/iron core. See note 1	B&W	3015
L-4	Inductor, 18 turns, 1" dia, 2½" long, tapped at 10 turns	B & W	3014

Parts List--RT-3 Transmitter

Part No.	Description	Manufacturer	Manufacturer's Type No.
Lamp-1	Lamp, 150 ma, incandescant #47		
N-1, N-2	Neon, Lamp assembly, 1/25 watt, in water-proof dome mounting	R D R	2000-1, 1001-A-54
P-1, P-5	Post, grounded, water-proof	R D R	1001-A-93-89
P-2, P-3	Post, insulated, water-proof	R D R	1001-A-93-98
P-4	Post, insulated, water-proof, w/insulated exterior	R D R	1001-A-93-88 (modified)
PL-1	Plug, 5 prong, miniature, molded, w/cable	R D R	8-SW-28 & 8-T.-55
R-1, R-4	Resistor, 47,000 ohm, ½ watt		
R-2	Resistor, 300 ohm, 1 watt		
R-3	Resistor, 5.6 megohm, ¼ watt		
R-5	Resistor, 10,000 ohm, ½ watt		
R-6, R-7	Resistor, 15,000 ohm, 2 watt		
R-8	Resistor, 2200 ohm, ½ watt		
R-9	Resistor, 300 ohm, 2 watt		
R-10, R-11	Resistor, 40,000 ohm, 1 watt		
R-12	Resistor, 25 ohm, 1 watt		
R-13	Resistor, 20 ohm, 1 watt		
RFC-1	RF Choke, 1 mh, 50 ma		

Part No.	Description	Manufacturer	Manufacturer's Type No.
C-2, RFC-4	RF Choke, 1 mh, 50 ma		
RFC-3	RF Choke, 2.5 mh, 125 ma		
SO-1	Socket, Assembly Crystal, .093" dia pin	R D R	8-TW-24
SO-2	Socket Assembly, Crystal, .125" dia pin	R D R	8-TW-25
SO-3	Socket Assembly, lamp bayonet type, molded	R D R	8-TW-12, & 8-TW-20 (modified)
SW-1	Switch, 4 position, bandswitch, ceramic insulation	Mallory	163-C
SW-2	Switch, loading (part of C-16)		
V-1	Tube, type 6AC7		
V-2	Tube, type 2E26	RCA	2E26
	Right Angle Drive	Millen	10012

Note 1: A powdered iron core increases inductance of this coil from .017 mh to .028 mh (Q=172). Core in laboratory model was made of 4 sections 3/4" dia X 3/8", powdered iron, type unknown. A single core piece to produce above inductance and Q should be used. Sample core material is available for tests by contractor.

List of Manufacturers:

Cardwell: Cardwell Manufacturing Corp.
97 Whiting Street
Plainville, Conn.

RDR : Radio Development and Research Corp.
26 Cornellson Ave.
Jersey City, N. J.

B & W : Barker and Williamson
235 Fairfield Ave.
Upper Darby, Pa.

Mallory : P. R. Mallory & Co., Inc.
3029 E. Washington St.
Indianapolis, Ind.

RCA : Radio Corporation of America
Camden, N. J.

Millen : James Millen Manufacturing Co.
150 Exchange St.
Malden, Mass.